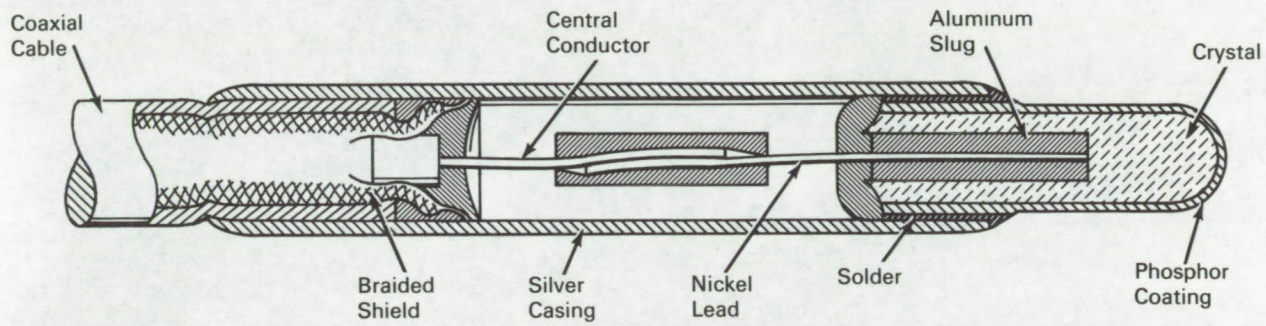
June 1966

Brief 66-10252

# NASA TECH BRIEF

NASA Tech Briefs are issued to summarize specific innovations derived from the U. S. space program and to encourage their commercial application. Copies are available to the public from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Semiconductor Forms Biomedical Radiation Probe




### The problem:

To produce a reliable miniaturized radiation dosimeter for biomedical application in vivo. External dosimeters do not accurately indicate dose level within the irradiated cells because the greater radiation damage is caused by photoelectrons and knock-on protons. Proposed chemical dosimeters for in vivo applications are only partially satisfactory since they will not indicate rate of absorption or number of particles absorbed.

### The solution:

A semiconductor radiation detector in the form of a slender probe that is easily inserted into body tissue. The probe has a signal-to-noise ratio that is acceptable to recording equipment and it provides realistic measurements of the spatial and energy distributions of radiant electrons and protons.

### How it's done:

The probe detecting element is a semiconductor diode of the junction type fabricated from a high resistivity silicon crystal doped with P-type impurities. The probe has the general shape of a clinical thermometer with the detector in the form of the mercury reservoir. The P-N type junction at the crystal is formed by the diffusion of phosphorus over the crystal surface. A silver casing holds the phosphorus coated crystal and connects with the ground lead (braided shield) of a miniature coaxial cable whose central conductor contacts a nickel lead from an aluminum slug in the body of the crystal. The silver casing is tin soldered to the phosphorus coated crystal by means of a nickel plate on the phosphorus and the other end is hermetically sealed to the coaxial cable external insulation that is impervious to body fluids.

In operation, reverse bias is applied to the P-N junction, and radiation penetrating the junction is converted to voltage pulses that are conducted to recording equipment via the coaxial cable.

### Notes:

1. This device would be useful in evaluating blood flow problems by insertion into veins and arteries to measure the spatial and energy distributions of radioactive tracers.

(continued overleaf)

This document was prepared under the sponsorship of the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that such use will be free from privately owned rights.

2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Manned Spacecraft Center
Houston, Texas 77058
Reference: B66-10252

**Patent status:**

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

Source: Fred P. Burns and Josef E. Friedericks
of Solid State Radiation Incorporated
under contract to
Manned Spacecraft Center
(MSC-320)